



Linear combination of Hamiltonian simulation for non-unitary dynamics with optimal state preparation cost



Dr. Jinpeng Liu

Mathematical Sciences Center
Tsinghua University

🎤 Host: 李彤阳 助理教授

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📍 静园五院204室

Abstract

We propose a simple method for simulating a general class of non-unitary dynamics as a linear combination of Hamiltonian simulation (LCHS) problems. LCHS does not rely on converting the problem into a dilated linear system problem, or on the spectral mapping theorem. The latter is the mathematical foundation of many quantum algorithms for solving a wide variety of tasks involving non-unitary processes, such as the quantum singular value transformation (QSVT). The LCHS method can achieve optimal cost in terms of state preparation. We also demonstrate an application for open quantum dynamics simulation using the complex absorbing potential method with near-optimal dependence on all parameters.

Ref: [1] Dong An, Jin-Peng Liu, Lin Lin. Physical Review Letters, 131(15):150603, 2023.

Biography

刘锦鹏，清华大学数学科学中心助理教授（2024年秋入职），2022-2024年在麻省理工和伯克利任博士后，2022年博士毕业于马里兰大学，2017年本科毕业于北航-中科院华罗庚班。本人研究方向为量子科学计算与量子科学智能，发表PNAS、Nat.Comm.、PRL、CMP、JCP、Quantum等期刊和NeurIPS、QIP、TQC等会议，受到Quanta、SIAM News、MATH+等科技媒体报道，曾获ICCM毕业论文奖（博士论文金奖）、James C. Alexander Prize、QISE-NET Award等，作为co-PI主持美国NSF一项种子基金，担任量子信息权威期刊Quantum (JCR Q1, IF 6.4) 的编委（中国高校仅3人）。